AN ESSAY

ON

TEMPERAMENT,

AND ON THE BEST MODE OF

TUNING

THE

PIANOFORTE.

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AN ESSAY

ON

TEMPERAMENT,

IN WHICH THE

THEORY AND PRACTICE

OF THAT IMPORTANT BRANCH OF MUSIC ARE

CLEARLY ESTABLISHED AND ILLUSTRATED

BY

PRECEPTS AND EXAMPLES,

CALCULATED

TO ASSIST YOUNG STUDENTS

IN TUNING, CORRECTLY, THE

PIANOFORTE.

BY

J. JOUSSE

(PROFESSOR OF MUSIC).

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TO

W. F. COLLARD, ESQ.

THIS ESSAY

IS RESPECTFULLY DEDICATED,

AS A MARK OF ESTEEM,

BY HIS FRIEND

THE AUTHOR.

April 30th,

1832.

PREFACE.

IT is needless to expatiate here on the necessity of proper tuning.

The finest pianoforte, either when out of tune or when tuned according to an improper temperament, loses, even under the hands of a great performer, the power of producing those delightful sensations which this same instrument is capable of eliciting when correctly tuned; also the effects produced by the extraordinary yet classical enharmonic changes, so frequent in the compositions of Haydn, Mozart, Beethoven, &c., depend on a proper temperament.

The business of a pianoforte tuner being totally different from that of the manufacturer, I will not tire the patience of my readers with a description of the materials and particulars of the pianoforte, its frame, key board, bars, bridges, &c. and the defects which may be inherent to these parts: suffice it to say that instruments made by manufac-

turers of acknowledged merit seldom require the assistance of a tuner to rectify any defect.

This small tract contains nothing but what is absolutely necessary to enable students to tune properly the pianoforte, or at least to understand the nature of tuning.

It is published at the request of some friends who think that some instructions on this subject are wanted, particularly in the country, where a good tuner is seldom to be procured.

It is with diffidence that the author presumes to lay this tract before the public; he is convinced of its utility, and knows the value of the principles which he has attempted to develope; but at the same time he is sensible of his own inadequacy to illustrate them as they deserve, and to shew their application throughout the modern system.

His chief claim to the indulgence of his readers is the novelty of the subject, and his chief ground of confidence is that his assertions are fully confirmed by experiments.

CONTENTS.

PRELIMINARIES.

MUSICAL SOUNDS are produced by the tremulous motion of the air, excited by the vibrations of some elastic sonorous body; and repeated experiments have proved that acute sounds are produced by quick, and grave sounds by slow, vibrations.

In all ages the greatest mathematicians and the most celebrated musicians have devoted their attention to the theory of sound. Pythagoras, a great philosopher and musician, invented the *harmonic canon* or *monochord**, an ingenious in-

* The monochord consists of a piece of planed deal, about three feet long and five inches wide, and thick enough not to warp; at each extremity is glued a square thin piece of wood, two or three inches high, thinned at the top, which forms a fixed bridge; over these resting points a string is extended, fastened at each end to a steel pin fixed to the board.

On the board are delineated the points at which the string must be stopped by a moveable bridge, to produce certain notes; by this means the respective proportion of each interval is accurately measured and the ratio ascertained.

The monochord appears to have been in constant use among the antients, as the best means of forming the ear to the accurate perception, and the voice to the true intonation, of those minute and difficult intervals which were then practised in melody.

strument, by which the relations between the various lengths of strings are accurately ascertained, and the musical ratios fixed; the gravity or acuteness of sounds is determined by the greater or less degree of velocity in the vibration of strings. After various experiments, he ascertained that, when a string of uniform thickness is reduced in length, it yields a sharper sound, provided its tension be not altered; for instance—

1. When a string, 30 inches in length, the sound of which is supposed to be C, is reduced to half its length, or to 15 inches, it gives another C, a perfect octave above the primitive sound.

2. When the string is reduced to three fourths of its original length, or to $22\frac{1}{2}$ inches, it sounds F, a perfect fourth to C.

3. If the string be reduced to 4 fifths, or 24 inches, it will give the sound E, a perfect 3rd to C. In a like manner any note within the compass of the string stretched on the monochord may be obtained, by regulating the length of the string to what is required, by means of the moveable bridge.

Sometime afterwards, Galileo Galilei*, a great philosopher, discovered the simultaneous resonance and the harmonic proportions into which a single string divides itself when sounding; also

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* This learned man was the son of Vincenzo Galilei; he was born at Pisa in 1564, and died in 1642.

the sympathy of perfect consonance in one string causing another string to sound that is tuned in unison, octave, or fifth. This was the means of extending the knowledge of harmonics by subsequent writers.

The following is a short account of this remarkable fact:—a string—such, for instance, as that which produces the lowest C on the pianoforte—when set in vibration by striking the key and keeping it pressed down, not only produces one principal sound, but, besides this, several other accessary sounds; undoubtedly because it divides itself into as many different parts as it contains aliquots, and because it sounds in each of these as if they were so many separate strings, but with less force than the principal sound, the only one audible to uncultivated ears. Here follows the series of the harmonics, which a practised ear feels sensibly.

1. C is produced by the whole length of the string set in vibration.

2. Another C, octave of the first sound, is produced by each half of the string, set in motion one after the other, or altogether. (See Ex. p. 12.)

3. G, a 5th above the second C and a 12th above the first, is produced from the third part of the string.

4. C, an octave above the second C, and the double octave above the first, is produced from one quarter of the string

5. E, a 3rd above the third C, a 10th above the second, and a 17th above the first C, is produced by one 5th of the string.

6. G, a 5th above the third C, a 12th above the second, and a 19th above the fundamental C, is produced by the 6th part of the string.

7. B, a 7th above the third C, a 14th above the second, and 21st above the fundamental C, is produced by the 7th part of the string: this note is flat.

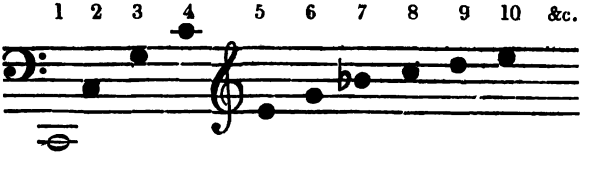
8. C, an octave above the third C, a double octave above the second, and triple octave above the fundamental, is produced by the 8th part of the string.

9. D, a major second above the fourth C, a 9th above the third C, a 16th above the second C, and a 23rd above the original C, is produced by the 9th part of the whole string.

10. E, a major 3rd above the fourth C, a 10th above the third, a 17th above the second, and 24th above the fundamental C, is produced by the 10th part of the string.

Here ends the series of the harmonics felt by the ear.

EXAMPLE.



SECTION II.

SHORT HISTORY OF TEMPERAMENT.

AMONG the antients there were three sects who had very different opinions concerning the precise compass or extent of each interval: the first were the *Pythagoreans*, or disciples of Pythagoras*, who maintained that reason alone was the proper judge of sounds and their proportions, and consequently that the forms of intervals were all rational; that is to say, they admitted none which could not be demonstrated, either arithmetically by numbers, or geometrically by lines; and that therefore the fifth must always have the proportion of 2, 3, the fourth that of 3, 4, the minor tone 9, 10, the major tone 8, 9, exactly; and, besides these, they fixed the proportion of many other intervals, which created subjects of dispute among several mathematicians.

But the ear (the judgment of which is very nice) does not agree to what was so fixed. Sometime after, Aristoxenus†, a disciple of Aristotle, thinking that, as sound was the chief object of the ear, the ear was the properest judge, gave himself no trouble about what the Pythagoreans said of reason; and observing that, if the 5th was too

* This great philosopher was born at Samos, in the time of Tarquin, last king of Rome, 533 years before Christ.

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The foregoing is the exact order of the notes produced on the trumpet and French horn, when sounded gradually from grave to acute.

OBS. 1. The figures under each note shew its ratio to the lowest sound.

OBS. 2. The notes with the + over them are not exactly the same as in the modern scale modified by temperament.

B♭ $\frac{1}{7}$ is a little flatter.

F $\frac{1}{11}$ is a little sharper.

A $\frac{1}{13}$ is a little flatter.

OBS. 3. The ratio of each note in the foregoing scale shews the number of vibrations made by the string in a certain time; for, supposing the whole string to vibrate once in a fixed time at the lowest C, it vibrates nine times at D $\frac{1}{8}$, and twenty-four times at G $\frac{1}{3/4}$.

From the number of the vibrations the consonance or dissonance of each note can be proved.

N.B. To have the major key of C according to the methods of Ptolemy and Tartini, E must be major third to the whole string, G a fifth to it, F a fourth to it, A a major third to F, B a major third to G, D a fourth below G, and C an octave to the whole string.

The Scale in its improved State.

Although the scale of nature contains every interval in its greatest perfection to the fundamental note, yet it does not answer all the purposes of modern composition; 1st, the lower octaves do not contain all the intervals of the acuter octaves —2nd, it does not admit of the same chords to one bass note as to another.

These deficiencies of the scale of nature are removed by two different improvements; viz. first, by its *completion*; second, by its *temperament.*

1. With respect to the *completion* of the scale of nature, it has been found that the series of sounds contained in the scale, from $\frac{1}{8}$ to $\frac{1}{16}$ could be introduced from 1 to $\frac{1}{2}$, or from $\frac{1}{2}$ to $\frac{1}{4}$, and even that the chromatic progression from $\frac{1}{16}$ to $\frac{1}{32}$ could be introduced in every octave. This has produced an extended scale, which is not confined to one key note only, as the scale of nature, but may suit twelve keys.

2. With respect to the *temperament* of the scale, it has been proved that, should every note of the octave be used as a key note, the original ratios of the intervals cannot be preserved; some intervals in most of the transposed scales being too sharp, or too flat: consequently it was found necessary to try—

First. Whether the original intervals could be tempered, and how much this could be done without destroying their original effect.

Second. In what manner the temperament of the scale could be distributed among the different intervals, so as to render any note of the scale as fit for a key note as another.

With respect to the first point, it is proved that all intervals, except the unison and octave, can bear a temperament without losing their original effect; and that they can be tempered more or less, according to the greater or less simplicity of their ratios: therefore concords can be less tempered than discords; and one concord more or less than another, according to the greater or less degree of its consonancy.

The unison and octave cannot bear any alteration; for their ratios $\frac{1}{1}$ and $\frac{2}{2}$ are so simple and comprehensive, that the least addition or deduction from them would be offensive to the ear.

The fifth and fourth admit of being tempered a little; the fifth may be made about half a comma flatter, and the fourth half a comma sharper than perfect, without offending the ear.

The minor sixth may be equal in temperament to the major third, and the major sixth to the minor third.

Respecting the second point, or the manner of distributing the temperament of the scale among different intervals, so as to render any note as fit for a key note as another, theorists do not perfectly agree; some incline for the *equal* temperament, [illegible] prefer the *unequal* temperament.—*(For an [illegible]tion of both, see Page* 28.*)*

SECTION I.

DEFINITION OF TEMPERAMENT.

THE word *temperament*, in an *extended* sense, denotes a small and almost imperceptible deviation from the original purity of intervals, rendered necessary by the different relations in which the notes are used in melody and harmony.

In a more *restricted* sense, it is an arranged system of sounds, in which some notes are deprived of part of their original purity, to bring all the notes used in the modern system into such a connection that each may form proper intervals with any other, and that each may, as a fundamental note to its own major or minor mode, have all the notes necessary to its scale.

The degrees of the octave, which Euclid terms its elements, as being the smallest intervals into which it is divided, are three major tones, two minor tones, and two major semitones, disposed in the following manner:

1	2	3	4	5	6	7	8
C	D	E	F	G	A	B	C
	a major tone.	a minor tone.	a maj^{r}. semi-tone.	a major tone.	a minor tone.	a major tone.	a maj^{r}. semi-tone.

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But the ear (the judgment of which is very nice) does not agree to what was so fixed. Sometime after, Aristoxenus†, a disciple of Aristotle, thinking that, as sound was the chief object of the ear, the ear was the properest judge, gave himself no trouble about what the Pythagoreans said of reason; and observing that, if the 5th was too

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great, or the 4th too small, they did not please the ear, he thought it necessary to diminish the one, and to increase the other. Again, thinking that, as the ear could find no sensible difference between major and minor tones, it was needless to divide them in this manner, he fixed them on an equality. This gave rise to a system termed by the Italians *Systema Ugale* (equal system).

Afterwards, Ptolemy† and Dydimus‡, seeing that the Pythagoreans and Aristoxenians went in their opinions to extremes equally absurd, taught that sense and reason were not to be considered as subject to each other, but as inseparable companions, which must agree to judge of sounds. This consideration set them to work (though somewhat differently) to fix the antient diatonic system in such a manner that reason and the ear might be satisfied at the same time. They invented a new system, called by the Italians *Systema Reformato*. The curious may see its proportions in *Zarlin*, *Kircher*, &c.

Observe, first, in all these systems, the fourth was composed diatonically of three intervals, a major tone, a minor tone, and a major semitone: secondly, that *Ptolemy* and *Dydimus*, among all their reformations, thinking that the minor tone

† Ptolemy, a great astronomer and musician, flourished about 130 years after the Christian era.

‡ Dydimus, an eminent musician of Alexandria, cotemporary with Nero.

could not be divided into two semitones, placed but one chromatic sound in the fourth, which divided the major tone into two semitones, one major, the other minor; therefore there was a sort of void in each tetrachord.

It being since found necessary to divide also the minor tone into two semitones, it was thought proper to enlarge the 4th and diminish the 5th; but no one had hitherto introduced such an alteration into the system, either from regard to antiquity, or from some other cause.

At length, a learned man, whose name is not mentioned in history, perceiving that the ear was not displeased if the 5th was a little diminished, found out an admirable *temperament*, which rendered the second tone of the 4th equal to the first, by giving the 4th a greater extent than it naturally had from its mathematical proportion of 3, 4; which tone admitted one chromatic note that divided it into two semitones. This fourth system is called by the Italians *Systema Temperato*.

By the help of this addition of one chromatic note, the octave may be divided into twelve semitones, without any void in or between the two tetrachords of which it is composed; and, at the same time, by this means two of the genera, viz. the chromatic and diatonic, are united into one system; for which reason it is termed *Systema Participato*, or *in participatione*.

SECTION III.

ON THE

NECESSITY OF TEMPERAMENT.

THE necessity of a temperament in music may be proved, both mathematically and by experiments.

First, by Mathematical Demonstrations.

At the natural generation of sounds, when each interval appears in its greatest purity, those necessary to a major or minor mode have the following proportions to their fundamental note:

The octave in the proportion... ...2 : 1	Major Second.... 9 : 8
Fifth.....3 : 2	Major Sixth... ... 5 : 3
Fourth... .....4 : 3	Minor Sixth... ... 8 : 5
Major Third.... ...5 : 4	Major seventh ...15 : 8
Minor Third.....6 : 5	Major semitone..16 :15

Consequently the degrees of the major scale of C natural have the following proportions to their fundamental note:

C,	D,	E,	F,	G,	A,	B,	C.
1	$\frac{8}{9}$	$\frac{4}{5}$	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{3}{5}$	$\frac{8}{15}$	$\frac{1}{2}$

Observe, in the foregoing scale all the intervals have their original proportions, except the minor third D, F, which, instead of having the proportion 6 : 5, occurs in the proportion 32 : 27; and the fifth D, A, which, instead of 3 : 2, has the proportion 40 : 27; therefore each of these intervals is deficient by a small interval called a *comma**.

Therefore, when, in any melody in the major mode of C, the note A, as a sixth of C, is used in the proportion of 5 : 3, and the bass plays to this A the note D, A is too flat as fifth to D by a *comma;* and as experience proves that the ear is offended at the deficiency of a whole comma in a consonance so perfect as the fifth, it is obvious that some expedient must be resorted to, and a *temperament* must take place.

This single example demonstrates the necessity of a *temperament* of some notes, even in a very simple and limited use of them: but this necessity becomes still more absolute when all the notes used in music are to be combined into a system, in which each note is not only to form serviceable intervals with all the others, but also to have, as a fundamental note of a major or minor mode, all the notes necessary to its scale in a proportion satisfactory to the ear.

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* A comma is the difference between a major tone and a minor tone, and is about as 80 to 81.

Secondly, the Necessity of Temperament may be proved by Experiments.

1. Supposing a pianoforte to be tuned, by a series of perfect octaves, from the lowest C to the highest, should a second pianoforte be tuned from the same pitch by a series of twelve perfect 5ths, thus: C G—G D—D A—A E—E B—B F♯—F♯ C♯—C♯ G♯—G♯ D♯—D♯ A♯—A♯ E♯—E♯ B♯, it will be found that this last note B♯ is not in tune with the upper C of the first pianoforte; that it is higher by a comma; but, on the pianoforte, B♯, being played on the same key as C, should be identically the same sound; therefore this discrepance must be removed by a proper *temperament*. The difference of pitch derived from B♯ or C after a succession of twelve perfect 5ths, and the corresponding C derived from a succession of octaves, is termed by tuners the *wolf**.

2. On the pianoforte three successive major thirds as C E—E G♯—or A♭—and A♭ C, form an octave. Now should these three major thirds be tuned perfect to each other, it will be found that they fall short of the perfect octave by a comma; so that one, two, or the three

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* The beatings produced by the dissimilar vibrations of the two strings B sharp and C give a disagreeable sound, which is not unlike the distant howling of a *wolf*.

thirds, must be altered and tuned sharper than perfect*.

On the contrary, four successive minor thirds, as C, E♭—E♭, G♭ or F♯—F♯, A—and A, C—exceed the octave by a comma.

Several ingenious attempts have been made to dispense with temperament. Two pianofortes were constructed, one by Mr. Hawkes and the other by Mr. Loeschman. Mr. Hawkes's pianoforte has one pedal only, by means of which the black keys are made either all sharps or all flats: so that altogether this instrument has a scale of seventeen sounds within the octave; that is to say, seven natural notes, five flats, and five sharps. The chief recommendation of this instrument is the simplicity and facility of the action, and its chief inconvenience seems to be that it is impossible to have a flat and a sharp at the same time; which, however, is the case in the chord of the diminished seventh, C♯ B♭, and in the extreme sharp sixth, B♭ G♯: so that in some cases the improvement falls short of avoiding intervals, altered by the diesis; but, to a great extent, it is an improvement on the old scale of twelve sounds to the octave.

Mr. Loeschman's pianoforte has twelve addi-

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* The octave bears some analogy to the circle; the circumference of the circle is a little more than three of its diameters; so the octave is a little more than three major thirds.

tional notes; it is exactly that proposed by Dr. Smith, only that the changes are effected by pedals, instead of stops for the hand which Dr. Smith proposed.

Mr. Loeschman carries the perfection of the harmony to a greater extent; but, by the necessary addition of pedals, the action becomes unavoidably more complicated.

The following observations on the construction of the pianoforte will facilitate to the student the intelligence of the foregoing articles.

In the modern system of music there are twenty-one distinct sounds:

1. Seven natural notes, viz:

C, D, E, F, G, A, B, C.

2. Seven notes with sharps,

C♯, D♯, E♯, F♯, G♯, A♯, B♯, C♯.

3. Seven notes with flats,

C♭, D♭, E♭, F♭, G♭, A♭, B♭, C♭.

These twenty-one sounds may be expressed on the violin and violoncello, also on the harp with the double action; but this cannot be done on the pianoforte and organ, which have only twelve keys in each octave. On these instruments the same key is made use of either for the sharp of the note below or for

the flat of the note above. Therefore C♯ and D♭, D♯ and E♭, F♯ and G♭, G♯ and A♭, and A♯ and B♭, are taken on the same keys: also, B♯ is played on C♮, and E♯ on F♮; but between the sharp of a note and the flat of another there is in theory a real difference*, which must be removed by the temperament: this is done by raising the lower and depressing the higher of these two notes in a trifling degree, so as to make them serve for each other: the ear can scarcely appreciate this alteration, therefore no unpleasant effect is produced.

To construct a pianoforte with a greater number of keys, and to be able to perform on it, would be attended with the greatest difficulties.

Having seen the impossibility of perfection on the pianoforte, which has a limited number of sounds in an octave, the student must next proceed to the study of the best temperament, or the best mode of dividing that imperfection over the whole scale.

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* The difference between C sharp and D flat, or between F sharp and G flat, &c. is called the *enharmonic diesis* or *quarter tone*.

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1. Seven natural notes, viz:

C, D, E, F, G, A, B, C.

2. Seven notes with sharps,

C♯, D♯, E♯, F♯, G♯, A♯, B♯, C♯.

3. Seven notes with flats,

C♭, D♭, E♭, F♭, G♭, A♭, B♭, C♭.

These twenty-one sounds may be expressed on the violin and violoncello, also on the harp with the double action; but this cannot be done on the pianoforte and organ, which have only twelve keys in each octave. On these instruments the same key is made use of either for the sharp of the note below or for

the flat of the note above. Therefore C♯ and D♭, D♯ and E♭, F♯ and G♭, G♯ and A♭, and A♯ and B♭, are taken on the same keys: also, B♯ is played on C♮, and E♯ on F♮; but between the sharp of a note and the flat of another there is in theory a real difference*, which must be removed by the temperament: this is done by raising the lower and depressing the higher of these two notes in a trifling degree, so as to make them serve for each other: the ear can scarcely appreciate this alteration, therefore no unpleasant effect is produced.

To construct a pianoforte with a greater number of keys, and to be able to perform on it, would be attended with the greatest difficulties.

Having seen the impossibility of perfection on the pianoforte, which has a limited number of sounds in an octave, the student must next proceed to the study of the best temperament, or the best mode of dividing that imperfection over the whole scale.

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* The difference between C sharp and D flat, or between F sharp and G flat, &c. is called the *enharmonic diesis* or *quarter tone*.

SECTION IV.

ON THE

VARIOUS SORTS OF TEMPERAMENT.

THERE are in music two sorts of temperament; the equal and the unequal.

When the imperfection inevitable on keyed instruments is distributed equally amongst the twelve notes, which compose an octave, it will be scarcely perceptible: all the 5ths being tuned flat, the 3rds will be rather sharp, and this will render the twelve keys equally imperfect, which is called *equal temperament.*

The *unequal temperament* takes place when some of the 5ths and 3rds are more perfect than by the *equal temperament* and others are less perfect. So that each of the twelve scales is tempered differently from any other.

Each of these temperaments has its advantages and disadvantages. The advantage obtained by the *equal temperament* is that every interval and

chord is produced so near perfection that none of them sound perceptibly imperfect; but it has the following disadvantages: first, it cannot be obtained in a strict sense, as may be proved, not only mathematically, but also by daily experience; therefore the best *equally tempered* instruments are still *unequally tempered*, and, what is worse, oftentimes in wrong places. Secondly, if it was perfectly obtained, it would produce no interval or chord quite perfect, although they would not be perceptibly imperfect. Thirdly, if the equal temperament could be obtained in perfection, the twelve diatonic major and minor scales would be reduced to two, as they would only differ in point of pitch, or gravity and acuteness, and not in effect.

The *unequal* temperament has two great advantages: first, it can be easily obtained in tuning, as is proved by daily practice. Secondly, it gives to every one of the twelve major and minor scales a particular character; but it has the disadvantage that it cannot be used in a large band, as it is impossible to make every performer temper his instrument in one and the same manner.

There are several systems of the *unequal* temperament: to explain them all would exceed the limits of this essay; therefore the author has confined himself to the two following methods which are in general use.

SECTION V.

THE EASIEST MODE OF TUNING THE PIANOFORTE.

OBS. I.—The greatest difficulty in tuning the pianoforte consists in making what tuners term the *bearings;* that is to say, to tune the twelve semitones of the octave so as to serve as a basis for tuning the rest of the instrument.

II.—About the compass of two octaves, in the middle of the key-board, is the best place for fixing the temperament. The strings being of a proper length (neither too long nor too short), the other notes above or below must be tuned in perfect octaves to the notes of the bearings.

III.—Those intervals which can bear little or no temperament are the most essential in every diatonic scale, as they are used more than the rest: these are the *octave*, the *fifth*, and the *third:* their temperament must be fixed in preference to all other intervals.

the flat of the note above. Therefore C♯ and D♭, D♯ and E♭, F♯ and G♭, G♯ and A♭, and A♯ and B♭, are taken on the same keys: also, B♯ is played on C♮, and E♯ on F♮; but between the sharp of a note and the flat of another there is in theory a real difference*, which must be removed by the temperament: this is done by raising the lower and depressing the higher of these two notes in a trifling degree, so as to make them serve for each other: the ear can scarcely appreciate this alteration, therefore no unpleasant effect is produced.

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* The difference between C sharp and D flat, or between F sharp and G flat, &c. is called the *enharmonic diesis* or *quarter tone*.

12. From F♯ descend to the octave below, which must be tuned perfect.

13. From the latter F♯ ascend a 5th to C♯.

Try the common chord A, C♯, E.

14. From C♯ ascend a 5th to G♯.

Try the common chord E, G♯, B.

Second Division by Fifths downwards.

15. From C (the pitch-note) descend a 5th to F: this 5th must be tuned rather sharp.

Try the common chord F, A, C.

16. From F descend a 5th to B♭, and tune it rather sharp.

Try the common chord B♭, D, F.

17. From B♭ tune the octave above, perfect.

18. From the upper B♭ descend a 5th to E♭, and tune it rather sharp.

Try the common chord E♭, G, B♭.

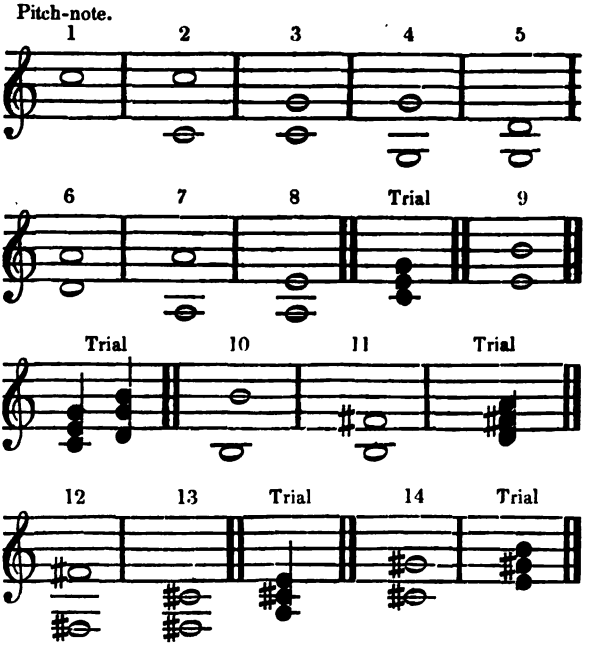
19. From E♭ descend a 5th to A♭.

Try the chord A♭, C, E♭: if your bearings are good, this A♭ must agree with G♯, already tuned.

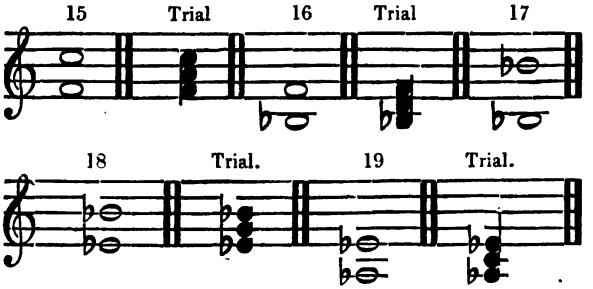
Lastly, when the bearings are properly fixed, tune the other notes above and below in perfect octaves to the notes of your bearings, beginning by the treble part.

EXAMPLE OF THE BEARINGS.

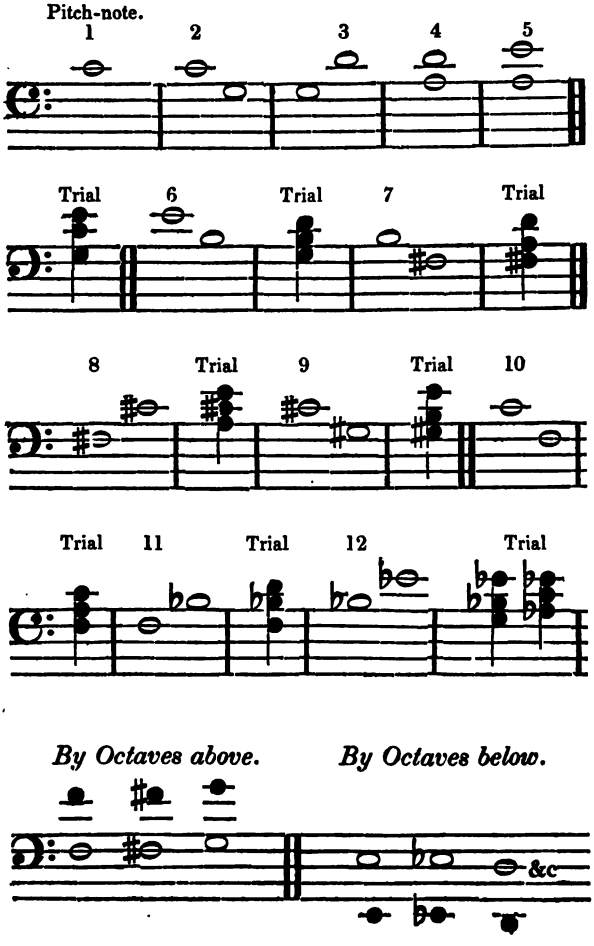
First Division, by Fifths upwards.



Second Division, by Fifths downwards.



EXAMPLE II.



Another Method of Tuning.

There is another way of tuning the pianoforte, which is by fourths downwards and fifths upwards, in the following manner:

1. Tune the C in the middle of the key-board in unison to the tuning-fork.
2. Tune the G below at a 4th from C. (Ex. 2.)
3. Tune D above at a 5th from G.
4. Tune A at a 4th below D.
5. Tune E at a 5th above A.

Try the three notes G, C, E.

6. From E tune B a 4th below.

Try the common chord G, B, D.

7. From B tune F♯ a 4th below.

Try the chord F♯, A, D.

8. From F♯ tune C♯ a 5th above.

Try the common chord A, C♯, E.

9. From C♯ tune G♯ a 4th below.

Try the three notes G♯, B, E.

10. From C (the pitch-note) tune F a 5th downwards.

Try the major common chord F, A, C.

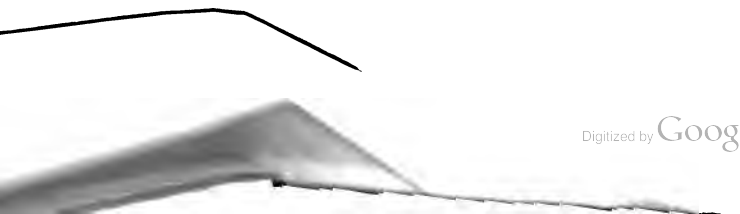
11. From F tune B♭ a 4th above.

Try the sixth and fourth, F, B♭, D.

12. From B♭ tune E♭ a 4th above.

Try the three notes G, B♭, E♭, and the common chord A♭, C, E♭.

Lastly. Tune all the other notes above and below the bearings in perfect octaves.



SECTION VI.

DIRECTIONS TO STUDENTS

FOR

TUNING THE PIANOFORTE WITH FACILITY.

I. THE tuning hammer must fit exactly the pins of the pianoforte; it must be held perpendicularly, and the pin must be moved very little either way, to avoid breaking the string.

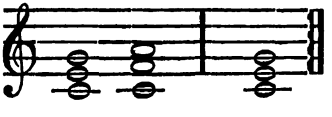
II. In tuning a square pianoforte, which has two strings to each note, one of them must be stopped or *damped*, by placing a small slip of wood covered with soft leather, or a piece of card, between the upper string of the note to be tuned and the lower string of the note above. When the string is tuned, the damper must be removed, and the second string tuned in perfect unison to the first.

III. In tuning a grand pianoforte, which has three strings to each note, a damper is not necessary; two of the strings being removed from the

hammers by pressing down the left-hand pedal, having previously raised the *bracket*, or small slip of wood which slides up and down a groove in the key-block, placed at the right-hand corner of the key-board. When the instrument is tuned throughout with one string only to each note, then the second string must be tuned in unison with the first. To do this, first lower the *bracket* which had been raised, then press the pedal down, and keep it so until the instrument is tuned: afterwards remove the foot from the pedal, and tune the third string in unison to the two others throughout the instrument.

When all the notes of the instrument have been tuned, the upper part should be gone over a second time; for, when the bass part is tuned, the treble gets a little flatter, owing to the additional tension of the lower strings.

IV. In tuning, do not dwell too long on any note; because the ear gets tired: but, if you think that you have tuned a note right, proceed to the next, and frequently strike the common chord of a note, and the sixth and fourth, thus:



By this process, the ear will be refreshed.

v. Most practitioners, in learning to tune, are apt to break the strings, owing to their tuning the fifths or the thirds too sharp: for when once you go beyond the mark, it requires a fine ear to distinguish on which side the fault lies. Therefore, if you are doubtful about a note being properly tuned, let down the string a little. As a further precaution, a learner should set the first note of the bearings rather below concert pitch, until he becomes more expert.

vi. In tuning, make the thirds as sharp and the fifths as flat as the ear will bear: but, as it is impossible to describe the precise degree of flatness or sharpness which these intervals should have, the best way is, first, to tune the third perfect, then to draw up the string a little higher; but that in so trifling a degree, as scarcely to hear a difference in the sound: likewise make your fifth perfect; after which, let down the wire by turning the pin back, but in a very trifling degree.

vii. In tuning each note throughout the instrument, great attention must be paid to the beatings; for when a fifth or an octave is quite perfect, no beating is heard; but, on the contrary, when either of these intervals is in any degree imperfect, a beating is always heard. A slow beating proves a slight deviation from perfection; on the contrary, a quicker beating shews that the deviation is greater; and from the equality of the beatings, equal

deviations from perfection may be correctly ascertained.

Observe—the pianoforte should be kept constantly at the *same pitch;* and, for this purpose, it must always be tuned strictly to concert pitch. From neglect in this respect, the instrument sustains much injury, and will not keep so well in tune.

Directions concerning the Strings.

The strings of the pianoforte are generally of steel for the treble part, brass for the upper notes of the bass, and steel, covered with copper wire, for the lower notes of the bass*. The size of the strings varies according to the size of the instrument; for the upper notes of a square pianoforte, No. 10, steel is used, the size increasing to 11, 12, &c. as the scale descends. When a string is wanting, first select one of the proper size, then make a small eye at one end of it by bending the wire and twisting it between your thumb and fore finger by means of the small hook fixed to the head of the tuning-hammer: this done, place the eye of the string on the hitch pin, then fasten the other extremity to the steel pin, and secure it by turning

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* Several manufacturers make use of plated copper wire for the bass; and some instruments of the latest improvement are strung entirely with steel, so that they are equally affected by the change of atmosphere.

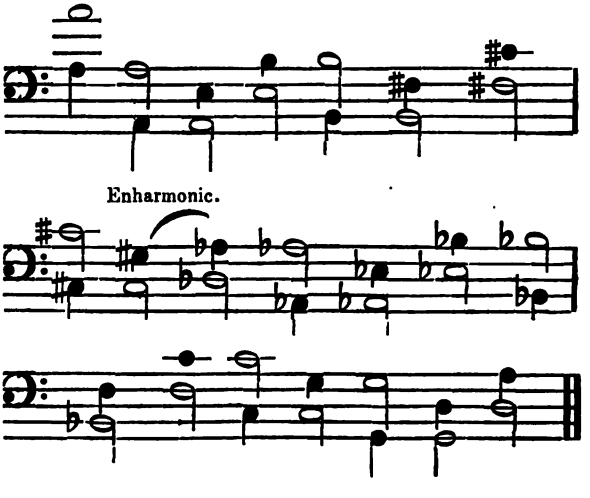
part of it underneath*: having fixed the pin in its hole in the block, and placed the centre of the string between the brass pins which are on the bridge, draw it up gently to the proper pitch.

N.B. A new string requires to be drawn several times before it keeps tune, as the tension causes it to stretch.

A Mode of Tuning in use among the German and French Musicians.

The pitch in France and Germany being taken from A instead of C, a mode of tuning according to this pitch is added here for the accommodation of foreigners.

Pitch-note.



* The principal manufacturers now use pins with holes drilled through them, so as to prevent all difficulty in fixing the string.

The upper note A, in the foregoing example, is the note which, in an orchestra, the oboe or flute gives to the violin and other stringed instruments. The bearings or temperament begin from this note, to which the tuning-fork is adapted in France and Germany; and the A of the pianoforte must be in perfect unison to that tuning-fork. The pitch-note being fixed, all the other notes must be tuned from it by fifths upwards, and octaves downwards when necessary, till the whole circle of fifths, which terminates at D, be gone through. If the last fifth, D A, be good, the bearings are properly fixed. and the remaining part of the instrument may be tuned by perfect octaves above and below the notes of the bearings.

FINIS.

JOSEPH MALLETT, PRINTER, WARDOUR STREET, SOHO.